

Identifying organic substances

1) Two bottles containing pent-1-ene, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{CH}_2$, and hexane, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$, require identification. Two reagents, bromine water, Br_2 , and acidified potassium permanganate, $\text{MnO}_4^- / \text{H}^+$, are available. Evaluate the possible use of BOTH reagents to distinguish between the pent-1-ene and hexane. In your answer you should include:

- a description of the type of reactions that would occur
- any conditions that would be required
- any observations that would be made
- equations showing the structural formulae of the organic reactant(s) and product(s).

2) State how you could distinguish between aminobutane, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$, and butanoic acid, $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$, using damp litmus paper. Give a reason for your answer.

3) Five colourless organic solutions that have no labels on their bottles are known to be:

- ethanoic acid
- aminoethane
- ethanol
- hexane
- hex-1-ene.

Discuss how each of these samples can be identified using **only** water, red and blue litmus paper, and bromine water.

In your answer, you must include a coherent scheme that would allow another student to follow your method, along with:

- the reagent used
- observations
- chemical equations that show the species reacting and products formed.

4) Samples of hexane, hex-1-ene and propanoic acid, require identification.

Only two reagents are available: acidified potassium permanganate solution, $\text{MnO}_4^- / \text{H}^+$, and sodium carbonate solution, Na_2CO_3 .

Discuss how each of the three samples can be identified using **only** the reagents above.

Your answer must include:

- a clear description of what you would do
- reagent used
- observations
- equations showing the structural formulae of organic reactant(s) and product(s).

5) The following substances require identification:

- acidified potassium dichromate
- bromine water
- methanol
- hexane
- hex-1-ene.

Two of these substances are orange in colour, the other three are colourless. Discuss, using only the five substances, how each could be identified. Your answer should include:

- a clear description of what you would do
- observations
- equations showing the structural formulae of organic substances for any reactions occurring.

6) Samples of **1-hexene** and **ethanoic acid** require identification. Two reagents are available: bromine water and zinc metal. Discuss reaction of the two samples with the reagents.

Your answer must include:

- the reagent used
- observations
- equations showing the structural formulae for any reactions occurring.

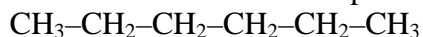
7) Three colourless organic liquids have no labels on the bottles. They are known to be pentanoic acid, pentan-1-ol and pent-1-ene.

Draw structural formulae for these three substances. Using only aqueous solutions of bromine and potassium permanganate, discuss how a student could identify the liquids. Your answer should include:

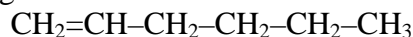
- what is done
- related observations
- conclusions made
- organic products for any reactions occurring.

- 8) a) (i) Identify a **chemical test** to distinguish between propanoic acid and propan-1-ol.
(ii) Describe the test to be carried out and the expected observations for each compound.

(b) The structural formulae for two compounds are given below:



hexane



hex-1-ene

Both compounds will react with bromine (Br_2), but under different conditions.

Discuss how the reactions with bromine could be used to distinguish between **hexane** and **hex-1-ene**.

In your answer include a description of expected observations, the conditions necessary for a reaction to occur, the type of reaction occurring and explanation for this, relevant equations and names of any products formed.

9) Chemical tests can be used to distinguish between pairs of compounds. Identify tests to distinguish between the following pairs of compounds and:

- (i) describe the test to be carried out,
 - (ii) describe the expected observations for the test used,
 - (iii) clearly explain how the test results can be used to distinguish between the molecules in each pair of compounds and why the test used is a suitable one.
- (a) butan-1-ol and but-2-ene
 - (b) butanoic acid and methylbutanoate.